A Force to Reckon With

Commercial Benefits—Spinoffs

From the development of smaller heart pumps, more compact audio speakers, robotic "bugs" that walk, and controls for airflow in automobile engines, to quieting the roar of aircraft engines, society can benefit from these advancements and more—all due to a little wafer with a big "wiggle." NASA's piezoelectric wafer technology has now been commercialized, sparking a broad range of potential applications in industry and scientific marketplaces.

NASA's Langley Research Center invented and patented the Thin-Layer Composite-Unimorph Ferroelectric Driver and Sensor (originally called THUNDER®, a trademark later registered by Face International Corporation). This technology is also known as Prestressed Piezoelectric Composites (PPC).

Several years ago, NASA researchers were exploring the well-known phenomenon exhibited by piezoelectric materials, which generate mechanical movement when subjected to a voltage. Such a property can be applied in electronics, optics, noise cancellation, pumps, valves, suppression of irregular motion, and a variety of other fields. This technology can also be used as a sensor in such applications as microphones, non-destructive testing, and vibration testing.

A remarkable feature of these devices is their ability to provide inordinately large mechanical output displacements, as high as 40 to 50 times the thickness of the device itself. That "wiggle" is an order of magnitude greater than existing devices operating in the same frequency range. What's more, these composite piezoelectric structures are tougher than current commercially available piezoelectric materials. The revolutionary devices have greater mechanical load capacity and can easily be produced at a relatively low cost, lending themselves well to mass production. The fabrication process for these devices is readily controllable, resulting in a highly uniform production.

NASA has granted licenses to two Virginia-based companies: Face International Corporation of Norfolk, Virginia, and Virginia Power and Electric Company of Richmond, Virginia.

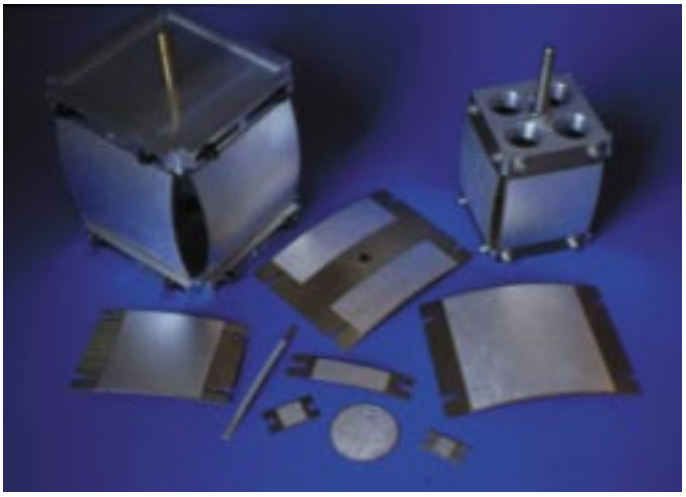
Face International has successfully commercialized its line of THUNDER® piezoelectric wafers. While offering piezoelectric actuators and sensors as standard products, Face International also sells "made-to-order" wafers, integrating customers' special configurations, hence, fulfilling the custom needs of clients.

Face International has exclusive license to develop actuator systems suitable for shaking concrete and processing other slurried materials. The company owns patents for using controlled acoustic energy (i.e., vibration or sound) to achieve the rapid setting of freshly poured concrete. They are also developing THUNDER®-based tools for surface finishing of wet concrete. These tools will impart certain vibrations to plastic concrete, facilitating the finishing of the slab. According to Face International officials, using piezoelectric devices to generate "smart" vibrational energy to work fresh concrete has never been done before. In addition, the company own patents for THUNDER®-based pumps, switches, and circuit breakers.

Face International is selling a variety of THUNDER® devices and is now capable of producing these and similar devices by the thousands on a monthly basis. By the first quarter of 2000, the company's manufacturing capacity is forecast to extend into the tens-of-thousands per month. Plans call for fully automated high-speed, high-volume production that can churn out quantities of a million-plus by the end of 2000.

Development of Virginia Power's NASDRIV™ devices is currently underway. The company is authorized to sublicense in a wide range of applications, excluding concrete-related applications.

The commercial possibilities for this small and forceful technology are staggering. ❖



Face International's THUNDER® devices provide inordinately large mechanical output displacements.